The Nysius Seed Bugs of Haleakala National Park, Maui (Hemiptera: Lygaeidae: Orsillinae)[1] [2]

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The genus *Nysius* is very well represented in the Hawaiian Islands, with over two dozen described species known (Ashlock, 1966; Usinger, 1942; Zimmerman, 1948). Most of these are endemic to the Hawaiian archipelago, although two foreign species have become established on the main islands, and a third species in the Leeward Islands, since 1960 (Ashlock, 1963; 1966; Beardsley 1965; 1971).

The species of *Nysius* are primarily seed feeders, although at times feeding by adults has caused damage to flowers and foliage of various plants, including crops and ornamentals. In Hawaii these bugs occur most commonly in the drier portions of the islands. They are less common in rainforest environments where they are partially replaced by representatives of endemic orsilline genera such as *Neseis* Kirkaldy and *Oceanides* Kirkaldy. In Hawaii *Nysius* species have been found associated with both endemic and introduced plants at altitudes ranging from sea level to over 13,000 ft. On Haleakala *Nysius* bugs are a conspicuous element of the insect fauna, and at times certain species may become extremely abundant. In the summit area large aggregations of these bugs, which apparently immigrate from lower elevations, have caused serious nuisance problems in and around scientific and communication installations (Beardsley, 1966).

This paper summarizes the known taxonomic and biological information about the *Nysius* species which occur in Haleakala National Park on the eastern portion of the island of Maui. Field work reported here was carried on sporadically over a period of more than 15 years, but mostly during 1964-65 and 1975-76. Areas covered included the western rim of Haleakala Crater from about 6,600 feet elevation to the summit; within the crater (numerous localities); and down Kaupo Gap to an elevation of 5,000 feet. I have also examined and identified *Nysius* specimens from these areas collected by R. Burkhart, D. E. Hardy, R.C.A. Rice and G. Teves. No data are available on *Nysius* populations within Kipahulu Valley, or in the vicinity of the Seven Sacred Pools. Collections from these areas may be expected to provide additional biological data, and possibly to add one or more additional species to those which are considered here.

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Identification

Considerable difficulty was experienced in attempting to use published keys to Hawaiian *Nysius* species (Usinger, 1942; Zimmerman, 1948). These keys rely heavily upon the relative length of the labium (rostrum) which in dried, point-mounted specimens is often difficult to determine due to concealment, bending etc. Also, labial length seems to be somewhat variable even within populations, so that the relatively slight differences which are used to differentiate between some of the species are not always evident. Although the labial characters still appear to be among the best available to distinguish between certain of the species present on Haleakala, I have attempted to provide supplementary characters which may aid in placing otherwise ambiguous specimens.

Nysius species exhibit a considerable degree of sexual dimorphism, and generally the females appear to be more easily identified than males on the basis of the external characters used in the key below. Males are generally smaller and narrower than females of the same species, and generally have the costal margins of the hemelytra less strongly expanded. This may result in some difficulty in placing unassociated male specimens. Ashlock (1963) found good taxonomic characters in the internal male and female genitalia of *Nysius* species, but as yet no comparative study of the genitalia of Hawaiian *Nysius* has been published. Unfortunately these structures must be carefully dissected and inflated before they can be properly studied.

Key to Nysius Species Known from Haleakala National Park
(Based on dry, point-mounted, adults)

1. Labium extremely long, extending well beyond posterior margin of third visable abdominal ventrite; head elongate, about as long as breadth across eyes ..... sp. near *abnormis*
- Labium shorter, extending no further than the posterior margin of the second abdominal ventrite, or rarely onto base of third; head usually distinctly broader than long 2
2. Very dark species, venter and antennae largely black, hemelytra mostly black with scattered paler spots 3
- Paler species, antenna largely fulvous or testaceous, hemelytra largely pale with various brown or blackish markings 5
3. Femora largely pitchy black; marginal area of corium with irregular black markings or largely black 4
- Femora pale with numerous black spots (sometimes confluent); marginal area of corium pale except for dark apical stripe ..... *nemorivagus*
4. Head relatively elongate, anteocular portion 1.4 to 1.5 times as long as eye; corium thickly clothed in short appressed pale pubescence, imparting a grayish cast; callosity at center of hind margin of pronotum not conspicuously pale ..... *lichenicola*
- Head shorter, anteocular portion 1.1 to 1.2 times as long as eye; corial pubescence relatively sparce; callosity at center of hind margin of pronotum usually conspicuously pale ..... *blackburni*

5. Labium short, ending between middle coxae, not reaching beyond apex of flat part of metasternum (fig. 1A); head relatively short (anteocular distance 1.0 to 1.2 times as long as an eye), either with a narrow, interrupted, longitudinal fulvous stripe, or if with a broad stripe, then with costal margins of hemelytra expanded, the curve of margin definitely divergent at about one-fifth distance from base, *and* color yellowish brown, not noticeably reddish tinged 6
- Labium slightly to conspicuously longer, extending beyond apex of flat part of metasternum, usually to base of first abdominal ventrite or beyond (fig. 1 B, C); head often more elongate (anteocular distance 1.4 times as long as an eye, or greater), if head relatively short, then dorsum of head with a broad, uninterrupted, fulvous band, *and* costal margins of hemelytra either not conspicuously expanded, or if expanded, color reddish brown 7
6. Membrane of hemelytra largely immaculate, or faintly infuscate; head black with a narrow, usually interrupted longitudinal fulvous stripe; costal margins of hemelytra relatively weakly expanded, the curve of the margin nearly uniform or only very slightly divergent at about one-fifth distance from base (fig. 2A)..... *coenosulus*
- Membranes of hemelytra usually definitely, irregularly, infuscate, with white base and veins; head with a broad uninterrupted fulvous stripe; costal margins of hemelytra more strongly expanded, the curve conspicuously divergent at one-fifth distance from base (fig. 2B) ..... *terrestris*
7. Costal margins of hemelytra relatively strongly expanded, curve of margin distinctly divergent at about one-fifth distance from base. (fig. 2C, D)..... 8
- Costal margins less strongly expanded, curve of margin relatively smooth, or slightly divergent at one-fifth distance from base (fig. 2E, F); if slightly divergent (*communis*) then labium relatively elongate, the tip extending well onto second visable abdominal ventrite (fig. 1B).. 9
8. Head relatively elongate, anteocular distance about 1.5 times as long as eye; pubescence of corium including scattered conspicuously elongate setae in addition to short, subappressed setae; membrane of hemelytra normally irregularly infuscate with veins pale; color mostly brownish, without strong reddish tinge ..... *beardsleyi*
- Head shorter, anteocular distance only slightly greater than length of eye (about 1.1 times); dorsum with thick, subappressed pubescence, but without conspicuous elongate setae; membrane clear or faintly infuscate; color definitely reddish tinged ..... *rubescens*
9. Labium extending to base of second abdominal ventrite(♂♂) or beyond (♀♀) (fig. 1B), first segment reaching base of head; size larger (♀♀ 6 - 6.7 mm long, ♂♂ 5.5 - 6 mm); head more elongate, anteocular distance about 1.4 times as long as eye ..... *communis*
- Labium not reaching second abdominal ventrite (fig. 1C), first segment usually not reaching base of head; size slightly smaller (♀♀ 5 - 5.7 mm, ♂♂ 4.3 - 5 mm); head shorter, anteocular distance about 1.2 times as long as an eye ..... *kinbergi*

Host Plant Relationships

Nysius species have been collected on a wide variety of vascular plants within Haleakala National Park. Three types of host plant relationships are apparent: 1) casual hosts or perching records (a few adult specimens from scattered localities taken on a particular host species); 2) aggregation hosts (hosts on or under which large numbers of adults aggregate, particularly, *Railliardia menziesii* in the summit area); and 3) breeding hosts (those on which eggs are laid, nymphs develop, and which frequently harbor resident populations of both adults and immatures). Apparently, it is the seeds of the breeding hosts, either on the plants or on the ground beneath them, which provide the primary food sources for the immature stages. The known breeding hosts of Haleakala *Nysius* species are summarized in Table 1.

On the basis of their breeding hosts and altitudinal distributions the *Nysius* species of Haleakala can be divided into two categories: 1) those with wide altitudinal distributions which normally reproduce on one or several introduced weeds in addition to native hosts (*coenosulus, communis, kinbergi* and *terrestris*), and 2) those not known to occur at lower elevations and which apparently reproduce only on native host plants (sp. near *abnormis, beardsleyi, lichenicola* and *rubescens*). No data are available on the breeding hosts of the two remaining species, *blackburni* and *nemorivagus.*

Taxonomy and Collection Notes

Nysius sp., near **abnormis** Usinger.

Nysius abnormis was described from a unique male from Molokai (Usinger, 1942). Additional specimens were collected by Ashlock and myself from *Styphelia* on Molokai, but these records have not been published. Haleakala specimens were compared with a male collected by me on Molokai during 1956. Some differences were noted in the relative proportions of body parts (e.g. a relatively elongate prothorax in Haleakala specimens) which suggest that these populations may not be conspecific. Further comparisons with Molokai specimens are needed to confirm this.

Adults of this species were taken on *Styphelia tameiameiae* at several locations (west rim, 7,400 ft; Kapalaoa, 7,280 ft; Puu Maile, 7,500 ft and along the Kaupo Trail, 5,000 - 5,500 ft). Nymphs which appear to be this species were collected in association with fallen fruits beneath a *Styphelia* bush at 7,400 ft along the west rim highway during August, 1974.

Nysius beardsleyi Ashlock.

Nysius beardsleyi Ashlock, 1966, Pacific Ins. 8:822.

This species appears to be attached to *Dodonaea eriocarpa.* Numerous specimens were collected from this host at 7,800 ft along the west rim highway, and along the Kaupo trail, 4,600 - 5,700 ft. It is known also from the island of Hawaii.

Nysius blackburni White.

Nysius blackburni White, 1881, Ann. Mag. Nat. Hist. (V) 7:53; Usinger, 1942, B. P. Bishop Mus. Bul. 173:99; Zimmerman, 1948, Ins. Hawaii 3:97.

Five specimens which appear to be this species were collected within Haleakala National Park; three from the vicinity of Paliku Cabin (6,300 - 7,000 ft), and two along the Kaupo Trail (5,000 - 6,100 ft). These were taken in general sweeping and in a malaise trap. Nothing is known about host relationships of this species in Haleakala.

Nysius coenosulus Stal.

Nysius coenosulus Stal, 1859, Eugenies Resa, Ins. 243; Usinger, 1959, Proc. Hawaii Entomol. Soc. 17:92.

Nysius nigriscutellatus Usinger, 1942, B. P. Bishop Mus. Bul. 173:102; Zimmerman, 1948, Ins. Hawaii 3:104.

This is a common widely distributed species found in the lowlands of all the main Hawaiian Islands. It reproduces on several introduced weeds (*Amaranthus* spp., *Chenopodium* spp., and *Portulacca oleracea*) as well as on the endemic *Chenopodium oahuense*. Adults and nymphs were collected on the latter host within Haleakala Crater near Namana-o-ke-Akua, 7,300 ft.

Large numbers of adult *N. coenosulus*, in company with *N. nemorivagus* at times aggregate in summit area in Haleakala, apparently after migrating from lower elevations (Beardsley, 1966). These aggregations have been mostly associated with scattered *Railliardia menziesii* plants. Apparently this species does not reproduce in the summit area.

Nysius communis Usinger.

Nysius communis Usinger, 1942, B. P. Bishop Mus. Bul. 173:110; Zimmerman, 1948, Ins. Hawaii 3:98.

This is another widely distributed species. It reproduces on certain species of Compositae. *Bidens pilosa* is a common breeding host in lowland areas. On Haleakala *N. communis* was commonly associated with *Railliardia menziesii* and both adults and nymphs were taken on this plant on the west rim of the crater up to the summit (10,000 ft). Adults were also collected on silversword flowers and from *Vaccinium, Styphelia* and *Metrosideros* at scattered localities on the west rim, within the crater, and along the Kaupo Trail, but there was no evidence of breeding on these hosts.

Nysius kinbergi Usinger.

Nysius kinbergi Usinger, 1959, Proc. Hawaii. Entomol. Soc. 17:92.

Nysius coenosulus, Usinger, 1942, B. P. Bishop Mus. Bul. 173:106 (misidentification); Zimmerman, 1948, Ins. Hawaii 3:98 (misidentification).

Nysius kinbergi reproduces principally on *Erigeron canadensis* in lowland areas of Hawaii. Usinger (1942) gave a detailed life history study and described the immature stages under the name *N. coenosulus*. Later (1959) he found this to have been a misidentification, and proposed the

presently accepted name. On Haleakala both adults and nymphs were found associated with *Tetramalopium* sp. in the summit area during October 1964. A few additional adult specimens were collected on *Railliardia* on the west rim, and one was taken on *Antemesia mauiensis* in Kaupo Gap (5,800 ft).

Nysius lichenicola Kirkaldy.

Nysius lichenicola Kirkaldy, 1910, Fauna Hawaiiensis 2:540; Usinger, 1942, B. P. Bishop Mus. Bul. 173:98; Zimmerman 1948, Ins. Hawaii 3:101.

Nymphs and adults of *N. lichenicola* were collected on seed heads of native grasses (*Trisetum glomeratum* and *Deschampsia australis*) at elevations ranging from 6,600 to 10,000 ft, on the west rim and within the crater. Adults were also collected frequently on *Styphelia.* It occurs also on the island of Hawaii.

Nysius nemorivagus White.

Nysius nemorivagus White, 1881, Ann. Mag. Nat. Hist. (V) 7:54; Usinger, 1942, B. P. Bishop Mus. 173:101; Zimmerman, 1948, Ins. Hawaii 3:101.

Like *N. coenosulus,* this species apparently reproduces at lower elevations and migrates in large numbers to the summit of Haleakala during the summer and fall. No information is available concerning the breeding hosts and nymphs of *N. nemorivagus.* On Haleakala adults have been collected mainly in aggregations associated with *Railliardia menziesii* (Beardsley, 1966). On Hawaii I have collected adults on *Chenopodium oahuense,* but it was not seen on this host on Maui.

Nysius rubescens White.

Nysius rubescens White, 1881, Ann. Mag. Nat. Hist. (V) 7:55; Usinger, 1942, B. P. Bishop Mus. Bul. 173:91; Zimmerman, 1948, Ins. Hawaii 3:105; Ashlock, 1966, Pacific Ins. 8:825.

This species is known from Haleakala and on Hawaii. It occurs between elevations of about 4,000 to 8,000 ft in association with *Vaccinium* spp. About two dozen specimens were collected from *Vaccinium reticulatum* and in a Malaise trap, at scattered localities within Haleakala National Park (Hosmer's Grove, Puu Mamane, Puu Maile, Paliku, and along the Kaupo Gap Trail, 5,000 to 5,500 ft).

Nysius terrestris Usinger.

Nysius terrestris Usinger, 1942, B. P. Bishop Mus. Bul. 173:95; Zimmerman, 1948, Ins. Hawaii 3:105.

Nysius terrestris is another widely distributed Hawaiian species which reproduces in lowland areas on weeds such as *Amaranthus* spp., *Chenopodium* spp., and *Portulacca oleracea.* During 1964 I found it reproducing on *Chenopodium oahuense* at Kula, Maui, and adults were collected on flowers and seeds of this host near Namana-o-ke-Akua (7,300 ft) within Haleakala Crater during August, 1964 and June, 1976. A few additional adults were collected on the west rim at altitudes ranging between 7,400 and 10,000 ft, on *Railliardia, Styphelia,* and in a Malaise trap.

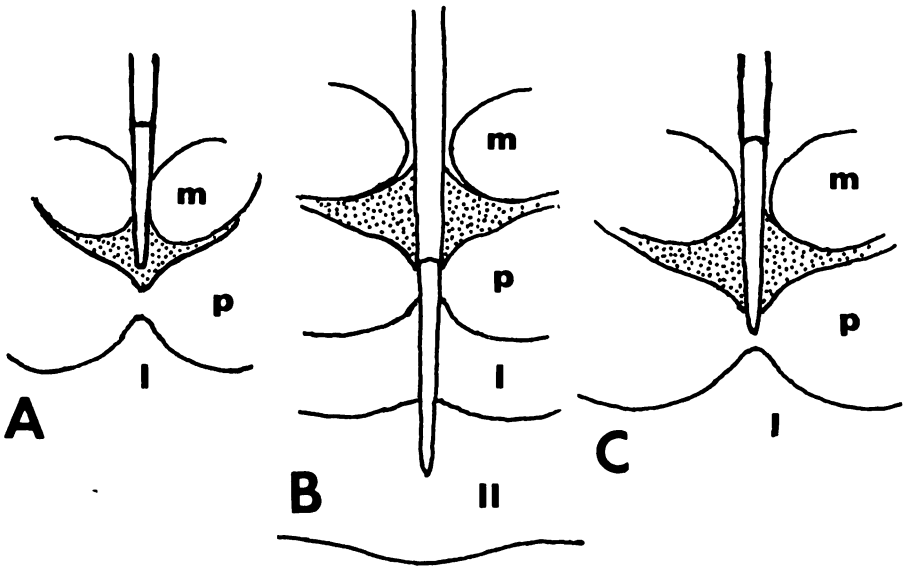

FIGURE 1. Sketches comparing position of distal portion of the labium in three common *Nysius* spp. A, *N. coenosulus;* B, *N. communis;* C, *N. kinbergi* (m = midcoxal cavity; p = posterior coxal cavity; I = first visable abdominal ventrite; II = second visable abdominal ventrite). Stippled area represents the flat part of the metasternum; drawings based on female specimens, all to the same scale.

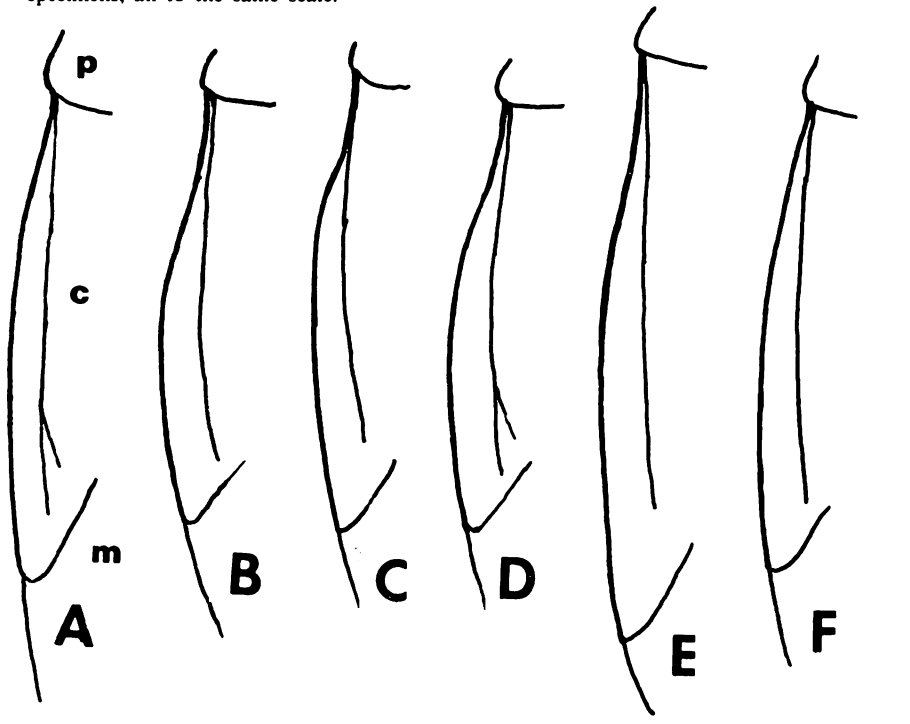

FIGURE 2. Sketches comparing costal margins of left hemelytra of several *Nysius* spp. from Haleakala. A, *N. coenosulus;* B, *N. terrestris;* C, *N. beardsleyi;* D, *N. rubescens;* E, *N. communis;* F, *N. kinbergi* (p = pronotum; c = corium; m = membrane). Longitudinal corial vein indicated is R + M; drawings based on female specimens, all to the same scale.

TABLE 1. *Known Breeding Hosts of* Nysius *spp. in Haleakala National Park.*

Nysius spp.	Host Plants
sp. nr. *abnormis*	*Styphelia tameiameiae*
*beardsleyi**	*Dodonaea eriocarpa*
coenosulus	*Chenopodium oahuense*
communis	*Railliardia menziesii*
kinbergi	*Tetramalopium* sp.
lichenicola	*Trisetum glomeratum*
	Deschampsia australis
*rubescens**	*Vaccinium reticulatum*
*terrestris**	*Chenopodium oahuense*

* Nymphs of these species were not collected within Haleakala National Park. Breeding association is assumed on the basis of consistant association of adults with these hosts and records of nymphs on these hosts from other areas.

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